

WHAT IS CLAIMED IS:

1. An electron beam apparatus comprising an electron source having an electron-emitting device, an electrode for controlling an electron beam emitted from said electron source, a target to be irradiated with an electron beam emitted from said electron source and a spacer arranged between said electron source and said electrode, characterized in that:

5 said spacer has a semiconductor film on the surface thereof that is electrically connected to said electron source and said electrode.

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2. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of 15 electron-emitting devices wired by wiring and said semiconductor film on the surface of said spacer is electrically connected to said wiring and said electrode.

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3. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of 25 electron-emitting devices wired by wiring and said spacer is arranged between said wiring and said electrode, said semiconductor film on the surface of said spacer being electrically connected to said wiring and said electrode.

4. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said spacer is a rectangularly parallelepipedic and arranged between said wiring and said electrode in such a way that the longitudinal direction thereof is in parallel with said wiring, said semiconductor film on the surface of said spacer being electrically connected to said wiring and said electrode.

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5. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said electrode is arranged on said target, said semiconductor film on the surface of said spacer being electrically connected to said wiring and said electrode.

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6. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said electrode is arranged on said target, said spacer being arranged between said wiring and said electrode, said semiconductor film on the surface of said spacer being electrically connected to said wiring and said electrode.

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7. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said electrode is arranged on said target, said spacer being 5 rectangularly parallelepipedic and arranged between said wiring and said electrode in such a way that the longitudinal direction thereof is in parallel with said wiring, said semiconductor film on the surface of said spacer being electrically connected to said wiring and 10 said electrode.

8. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed 15 wirings to form a matrix wiring structure and said semiconductor film on the surface of said spacer is electrically connected to at least one of said row-directed wirings or said column-directed wirings 20 and to said electrode.

9. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed 25 wirings to form a matrix wiring structure and said spacer is arranged between at least one of said

row-directed wirings or said column-directed wirings and said electrode, said semiconductor film on the surface of said spacer being electrically connected to at least one of said row-directed wirings or said 5 column-directed wirings and to said electrode.

10. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed 10 wirings to form a matrix wiring structure and said spacer is rectangularly parallelepipedic and arranged between at least one of said row-directed wirings or said column-directed wirings and said electrode in such 15 a way that the longitudinal direction thereof is in parallel with said wirings, said semiconductor film on the surface of said spacer being electrically connected to at least one of said row-directed wirings or said column-directed wirings and to said electrode.

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11. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed 25 wirings to form a matrix wiring structure and said electrode is arranged on said target, said semiconductor film on the surface of said spacer being

electrically connected to at least one of said row-directed wirings or said column-directed wirings and to said electrode.

5 12. An electron beam apparatus according to claim 1, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure and said 10 electrode is arranged on said target, said spacer being rectangularly parallelepipedic and arranged between at least one of said row-directed wirings or said column-directed wirings and said electrode in such a way that the longitudinal direction thereof is in 15 parallel with said wirings, said semiconductor film on the surface of said spacer being electrically connected to at least one of said row-directed wirings or said column-directed wirings and to said electrode.

20 13. An electron beam apparatus according to any of claims 1 to 12, wherein said semiconductor film has a surface electric resistance between 10^5 [Ω/\square] and 10^{12} [Ω/\square].

25 14. An electron beam apparatus according to any of claims 1 to 12, wherein a plurality of spacers are arranged.

15. An electron beam apparatus according to any of claims 1 to 12, wherein said electrode accelerates electron beam emitted from said electron source.

5 16. An electron beam apparatus according to any of claims 1 to 12, wherein said electron-emitting device is a cold cathode device.

10 17. An electron beam apparatus according to any of claims 1 to 12, wherein said electron-emitting device has an electroconductive film including an electron-emitting region between a pair of electrodes.

15 18. An electron beam apparatus according to any of claims 1 to 12, wherein said electron-emitting device is a surface conduction electron-emitting device.

20 19. An electron beam apparatus comprising an electron source having an electron-emitting device, an electrode for controlling an electron beam emitted from said electron source, a target to be irradiated with an electron beam emitted from said electron source and a spacer arranged between said electron source and said electrode, characterized in that:

25 said spacer has a semiconductor film on the surface thereof that is electrically connected to said

electron source and said electrode and is provided with abutting members arranged at the abutments of said spacer and said electron source and said electrode.

5 20. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said semiconductor film on the surface of said spacer is electrically connected to said wiring and said 10 electrode.

15 21. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said spacer is arranged between said wiring and said electrode, said semiconductor film on the surface of said spacer being electrically connected to said wiring and said electrode.

20 22. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said spacer is a rectangularly parallelepipedic and arranged between said wiring and said electrode in such a way 25 that the longitudinal direction thereof is in parallel with said wiring, said semiconductor film on the surface of said spacer being electrically connected to

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said wiring and said electrode.

23. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said electrode is arranged on said target, said semiconductor film on the surface of said spacer being electrically connected to said wiring and said electrode.

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24. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said electrode is arranged on said target, said spacer being arranged between said wiring and said electrode, said semiconductor film on the surface of said spacer being electrically connected to said wiring and said electrode.

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20 25. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and said electrode is arranged on said target, said spacer being rectangularly parallelepipedic and arranged between said wiring and said electrode in such a way that the longitudinal direction thereof is in parallel with said wiring, said semiconductor film on the surface of said

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spacer being electrically connected to said wiring and said electrode.

26. An electron beam apparatus according to claim 5 19, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure and said semiconductor film on the surface of said spacer is 10 electrically connected to said row-directed wirings or said column-directed wirings and said electrode.

27. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure and said spacer is arranged between said row-directed wirings or said column-directed wirings and said electrode, said 15 semiconductor film on the surface of said spacer being electrically connected to said row-directed wirings or said column-directed wirings, whichever appropriate, and said electrode.

25 28. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of

row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure and said spacer is a rectangularly parallelepipedic and arranged between said row-directed wirings or said

5 column-directed wirings and said electrode in such a way that the longitudinal direction thereof is in parallel with said wirings, said semiconductor film on the surface of said spacer being electrically connected to said row-directed wirings or said column-directed

10 wirings, whichever appropriate, and said electrode.

29. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure and said electrode is arranged on said target, said

15 semiconductor film on the surface of said spacer being electrically connected to said row-directed wirings or

20 said column-directed wirings and said electrode.

30. An electron beam apparatus according to claim 19, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure and said electrode is arranged on said target, said spacer being

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rectangularly parallelepipedic and arranged between
said row-directed wirings or said column-directed
wirings and said electrode in such a way that the
longitudinal direction thereof is in parallel with said
5 row-directed wirings or said column-directed wirings,
whichever appropriate, said semiconductor film on the
surface of said spacer being electrically connected to
said row-directed wirings or said column-directed
wirings, whichever appropriate, and said electrode.

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31. An electron beam apparatus according to any
of claims 19 to 30, wherein said abutting members of
said spacer operate for both mechanically securing said
spacer to said electron source and said electrode and
15 electrically connecting the semiconductor film on said
spacer to said electron source and said electrode.

32. An electron beam apparatus according to any
of claims 19 to 30, wherein each of said abutting
20 members of said spacer include a first member operating
for mechanically securing said spacer to said electron
source or said electrode and electrically connecting
the semiconductor film on said spacer to said electron
source or said electrode.

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33. An electron beam apparatus according to any
of claims 19 to 30, wherein said semiconductor film has

a surface electric resistance between 10^5 [Ω/\square]
and 10^{12} [Ω/\square].

34. An electron beam apparatus according to any
5 of claims 19 to 30, wherein a plurality of spacers are
arranged.

35. An electron beam apparatus according to any
of claims 19 to 30, wherein said electrode accelerates
10 electron beam emitted from said electron source.

36. An electron beam apparatus according to any
of claims 19 to 30, wherein said electron-emitting
device is a cold cathode devices.

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37. An electron beam apparatus according to any
of claims 19 to 30, wherein said electron-emitting
device has an electroconductive film including an
electron-emitting region between a pair of electrodes.

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38. An electron beam apparatus according to any
of claims 19 to 30, wherein said electron-emitting
device is a surface conduction electron-emitting
device.

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39. An electron beam apparatus comprising an
electron source having an electron-emitting device, an

electrode for controlling an electron beam emitted from said electron source and a target to be irradiated with an electron beam emitted from said electron source, characterized in that:

5 it further comprises a spacer arranged between at least two electrodes adapted to have respective electric potentials that are different from each other and said spacer has a semiconductor film on the surface thereof that is electrically connected to said
10 electrodes and is provided with abutting members arranged at the abutments of said spacer and said electrodes.

40. An electron beam apparatus according to claim
15 39, wherein said electron source includes a plurality of electron-emitting devices wired by wiring and one of said electrodes is said wiring.

41. An electron beam apparatus according to claim
20 39, wherein one of said electrodes is arranged on said target.

42. An electron beam apparatus according to claim
25 39, wherein said electron source includes a plurality of electron-emitting devices wired by a plurality of row-directed wirings and a plurality of column-directed wirings to form a matrix wiring structure and one of

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said electrodes is said row-directed wirings or said column-directed wirings.

43. An electron beam apparatus according to claim 5 39, wherein one of said electrode accelerates electron beam emitted from said electron source.

44. An electron beam apparatus according to any of claims 39 to 43, wherein said abutting members of 10 said spacer operate for both mechanically securing said spacer to said electrodes and electrically connecting the semiconductor film on said spacer to said electrodes.

15 45. An electron beam apparatus according to any of claims 39 to 43, wherein each of said abutting members of said spacer include a first member operating for mechanically securing said spacer to one of said 20 electrodes and electrically connecting the semiconductor film on said spacer to one of said electrodes.

46. An electron beam apparatus according to any of claims 39 to 43, wherein said semiconductor film has 25 a surface electric resistance between 10^5 [Ω/\square] and 10^{12} [Ω/\square].

47. An electron beam apparatus according to any of claims 39 to 43, wherein a plurality of spacers are arranged.

5 48. An electron beam apparatus according to any of claims 39 to 43, wherein said electron-emitting device is a cold cathode device.

10 49. An electron beam apparatus according to any of claims 39 to 43, wherein said electron-emitting device has an electroconductive film including an electron-emitting region between a pair of electrodes.

15 50. An electron beam apparatus according to any of claims 39 to 43, wherein said electron-emitting device is a surface conduction electron-emitting device.

20 51. An electron beam apparatus according to claim 1, wherein said apparatus is an image forming apparatus.

25 52. An electron beam apparatus according to claim 19, wherein said apparatus is an image forming apparatus.

53. An electron beam apparatus according to claim

39, wherein said apparatus is an image forming apparatus.

5 54. An electron beam apparatus according to claim 1, wherein said spacer has a conductive film on the areas thereof abutting with said electron source and said electrode, said conductive film being electrically connected to said semiconductor film.

10 55. An electron beam apparatus according to claim 19, wherein said spacer has a conductive film on the areas thereof abutting with said electron source and said electrode, said conductive film being electrically connected to said semiconductor film.

15 56. An electron beam apparatus according to claim 39, wherein said spacer has a conductive film on the areas thereof abutting with said electrodes, said conductive film being electrically connected to said 20 semiconductor film.